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TITLE: Method and apparatus for detection of parallel edges in image processing

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INVENTOR-INFORMATION:

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US-CL-CURRENT: 382/200, 382/203

ABSTRACT:

A method and apparatus for detection of parallel edges in image processing systems is shown. A video source producing an image which is operated upon by Laplacian of Gaussian operator to produce an LOG image within which sign changes are detected to produce a zero crossing edge detected image. A vector gradient field of the LOG image is computed and subjected to a gradient field smoothing operation to produce a smoothed gradient field. The smoothed gradient field is examined to detect scaler minima within the field and the results thereof used to compute parallelism strength in accordance with preestablished criteria to generate a parallelism line image which is printed

using a conventional printer.

12 Claims, 25 Drawing figures

Exemplary Claim Number: 1

Number of Drawing Sheets: 7

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Detailed Description Text - DETX (5):

This convolution relates in a smoothed **gradient vector** field which is coupled to minima detection means 23. It has been found that two closely spaced **edges of opposite orientation** in the gradient field will produce a minimum magnitude in the smoothed **gradient vector** field at a point halfway between the edges. Thus, it has been found that detection of a minima in a smoothed gradient field produce a series of points representing the desired parallelism line. Accordingly, minima in the magnitude component of smoothed **gradient vector** field correspond to points of parallelism, near symmetry in the edge image. Thus, minima detector 23 is operative solely upon the magnitude component of the smoothed **gradient vector** field. It has been found that two possible approaches are evident for the detection of magnitude minima. The first is referred to as directionally independent minima while the second is referred to as directionally dependent minima. Directionally independent minima arise in situations in which a signal point

of minimum value is found
and, as a result, movement in any direction
therefrom produces an increased
magnitude. In contrast, directionally dependent
minima corresponds to a line
or plane in which the minimum magnitude exists at a
plurality of points in one
or more directions while an increase in magnitude
results in certain directions
only. Directionally dependant minima approximately
corrrespond to the axis of
symmetry of an object.

Detailed Description Text - DETX (15):

While the values associated with each of the
above quantities may be
explicitly and accurately computed at each
parallelism pixel, such an approach
has not been found to be practical. A more
practical approach has been found
which uses two measures of parallelism strength
which relates indirectly to the
above quantities. The first measure which can be
computed is the magnitude of
the smoothed **gradient vector** field at each point on
the parallelism line. In
this computation, equal strength (contrast) edges
one hundred eighty degrees
apart in orientation will produce a near zero value
smoothed gradient
magnitude. In contrast, **edges of different edge
strength or orientation**
produce a greater smoothed gradient magnitude.
Thus, a small smoothed gradient
magnitude is an approximate indicator of a high
degree of parallelism and
similarity of edge strength.